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ABSTRACT

Testing the assumption that textbooks were getting harder while students' abilities have been declining over the years, a study was conducted to determine the readability levels of six college reading textbooks across three editions to see if they were equal or the same in readability. The study also sought to determine whether these texts were generally written at the same levels of difficulty. The Fry Readability Graph was used to evaluate the textbooks. The results showed that the readability levels of the individual editions varied up to six grade levels. It was further shown that over a span of three editions there was little consistency in readability levels between editions, with the later editions being generally more difficult. (Author/RL)

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HOW DO THE READABILITY LEVELS OF COLLEGE READING TEXTBOOKS OF THREE EDITIONS COMPARE?

by

June Zymroz

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II. THE READING RANGE OF COLLEGE READING TEXTBOOKS OVER THE SPAN OF THREE EDITIONS.....6

Bormouth (1973) states that

> A person should be literate enough to perform well enough to obtain maximum value from the materials he needs to read.

In education there is great concern that equality exist between students and their textbooks. Peterson (1974) suggests that textbooks are getting harder while students abilities are or have been declining over the years. But the research in this area is contradictory and confusing. Knowledge of the past often helps shed light and suggests solutions to today's problem. Knowledge of the readability of reading textbooks over several editions could provide insights to educators on which to make evaluations and judgments but little has been done to provide such information.

In a study conducted at a community college in Missouri Cline (1971) found eleven of the seventeen textbooks used in the Freshman year to have a mean readability level of 13.0 grade equivalent and were above the reading abilities of at least 75% of the students in corresponding classes. Osborne's (1979) research at a Nebraska college, again using freshmen students, found his sample to have a mean reading level of 12.3, but that sophomores had a mean reading level of 13.1. He further revealed that 43% of these students were found to be at the frustration level when their scores were compared to 38% of their textbooks. In a junior college population

Hagstrom (1971) found fourteen of nineteen textbooks were more than one grade level above the reading ability of the students and that five textbooks, with a readability level of grade 16.0, were being used by students with an ability range of from 10.9 to 12.2. In a more recent studey conducted at Kean College by Lane and Reidler (1980) analyses of textbooks used by freshmen revealed a readability level of grade 13 - 16 while the mean reading level of the freshmen were at 11.07 grade level.

In a study to determine the readability of the same college textbooks over several editions, Dr. Mazurkiewicz (1980) reported that Santa and Burstyn of Rutgers analyzed books on psychology and economics and found the earlier editions had a 10 - 12 grade level while the more recent editions ranged from 13 - 16 grade level. This study also indicated that in recent editions the number of concepts increased. This research tends to contradict information reported "by publishers" that textbooks are being written at easier levels, but the evidence is as yet scanty.

Hypothesis

To provide additional evidence concerning this topic a study was conducted to determine the readability levels of textbooks used in the preparation of teachers over three editions to determine if they were equivalent or different.

Definitions

Edward Fry's Graph for estimating readability - extended, was used in this study. In determining the counting of symbols, a word is defined as a group of symbols with a space on either side; thus, "Joe," "IRS," "1945," and "&" is one word. While counting syllables for numerals and initializations, count one syllable for each symbol. For example, "1945" is four syllables, "IRS" is three syllables, and "&" is one syllable.

Fry's formula correlates with five other reading formulas providing uniformily high relationships as noted below:

SRA	0.98
Flesch	0.96
Dale-Chall	0.94
Spache	0.93
Botel	0.78

Procedure

Three editions of the following Reading textbooks were analyzed using the Fry readability formula - extended.

Spache, George., Evelyn B. Spache
Reading in the Elementary School 1977, 1973, 1969

Gray, Lillian
Teaching Children to Read 1963, 1957, 1949

Harris, Albert J.
How to Increase Reading Ability 1975, 1970, 1961

Tinker, Miles Albert
Teaching Elementary Reading 1975, 1968, 1952

Heilman, Arthur W.
Principles and Practices of Teaching Reading 1977, 1972, 1967

DeBoer, John J., Martha Dollman
The Teaching of Reading 1970, 1964, 1960

At least three one hundred word sample passages from each book were evaluated. The average number of syllables and the average number of sentences of the samples were plotted on the graph to determine the grade level of the material.

The results of the evaluations were analyzed to determine if the readability of any one text over the span of three editions is the same. The results also permitted a comparison of textbooks to determine whether the readability of college Reading texts differ significantly.

Results

Table I shows that the readability levels of college Reading textbooks over the span of three editions are not consistent, vary as much as five readability levels from edition to edition, and that later editions are generally more difficult. Three groups of Reading textbooks have two editions which are comparable in readability and the third edition's readability level is shown to be near the first two. Two of Spache and Spache's editions have a readability

of the 14th level with the other edition at the 12th level.

Table 1

The Readability Levels of College Reading Textbooks Over the Span of Three Editions

Authors	Editions	Readability Levels
Spache and Spache	1969	14th
	1973	12th
	1977	14th
Gray	1949	11th
	1957	11th
	1963	13th
Harris	1961	8th
	1970	11th
	1975	13th
Tinker	1952	11th
	1968	14th
	1975	15th
Heilman	1967	12th
	1972	16th
	1977	13th
DeBoer and Dollman	1960	13th
	1970	12th
	1978	13th

Gray's 1949 and 1957 editions have 11th grade readability while the 1963 edition has a readability at the 13th grade level. DeBoer and Dollman have two editions at the 13th level and one edition at the 12th readability level. The other three groups of texts, Tinker, Heilman, and Harris show different levels for each edition with a greater span of readability levels. Harris' 1961 edition has the lowest readability level at the 8th grade. Of all the texts studied, Heilman's 1972 edition has the highest level: the 16th grade.

The table also illustrates that, with the exception of

Heilman's text, the latest edition of the college Reading textbooks have a readability level equal to, or higher than their previous editions.

Table II

The Reading Range of College Reading Textbooks Over the Span of Three Editions

Authors	Edition	Reading Range	Number of Grade Levels Within the Reading Range
Spache and Spache	1969	13-16	4
	1973	10-13	4
	1977	13-16	4
Gray	1949	9-13	5
	1957	11-12	2
	1963	13-13	0
Harris	1961	7- 9	3
	1970	11-12	2
	1975	11-16	6
Tinker	1952	8-13	6
	1968	12-16	5
	1975	15-15	0
Heilman	1967	11-13	3
	1972	15-17	3
	1977	11-15	5
DeBoer and Dollman	1960	13-14	2
	1970	10-13	4
	1978	11-14	4

Table II illustrates the similarities and differences between college Reading textbooks. There is a reading range throughout the editions from the 7th grade level through the 16th level. Individual editions either have no variability, that is, they are essentially at one readability level (Gray, 1963: Tinker, 1975), or they have a range up to six grade

levels. Spache and Spache's textbooks show the greatest consistency. Two editions, 1969 and 1977, have the same reading range of 13 through 16, and the same number of grade levels within the range. The readability ranges of all the other texts vary within the editions.

There are more similarities between the number of grade levels within the reading ranges of the textbooks than differences. DeBoer and Dollman's two latest editions, 1970 and 1978, have a range of four grade levels, the same as Spache and Spache's three texts. Heilman's editions, 1967 and 1972, and Harris' 1961 editions have a range of three grade levels. Those editions with a range of five grade levels are Gray's 1949, Tinker's 1968, and Heilman's 1977. The two editions with the greatest number of readability levels are Harris' 1975 and Tinker's 1952 texts. Gray's 1957 and DeBoer and Dollman's 1960 editions show a narrow two readability difference while the two textbooks which maintain the same grade level designation throughout are Gray's and Tinker's latest editions.

Conclusion

This research study was undertaken to determine the readability levels of college Reading textbooks over the span of three editions. It was hypothesized that these textbooks were near the same readability levels.

The results, ascertained by using Fry's graph, show the readability levels of individual editions can vary up to six levels. It is further shown that over a span of three editions there is generally little consistency in readability between editions.

The findings which indicate that most of the latest editions of the Reading textbooks were written at a more difficult level agrees with the findings of researchers Santa and Burstyn of Rutgers who found the latest editions of Economics and Psychology textbooks to range from 13 - 16 grade levels. Lane and Reidler of Kean College, in their study, also found textbooks used by college freshmen at Kean to have this same level of reading difficulty.

Since research studies by Cline (1971), Hagstrom (1971), and Osborne (1979) have shown the reading levels of freshmen and sophomore students to be lower than their textbooks, and a more recent study by Lane and Reidler (1980) showing Kean College freshmen to have a reading level of 11.07, this study further demonstrates the urgent need to increase the reading skills of students at the high school and/or college levels. Then, hopefully, the interaction between students' and their textbooks will be at a level where maximum understanding and learning can take place.

One way to predict whether a piece of writing is likely to be readable to a particular group of readers in education or mass communication is to evaluate the material. A readability formula uses counts of language variables in a piece of writing to provide an index of probable difficulty for readers. However, Chall (1949) points out that formulas are limited: they do not adequately account for conceptual difficulty, semantic variations of commonly used words, human interest and relative number of ideas. Their main purpose is to provide objective information to be used as a guide in matching appropriate level reading materials with readers' capabilities so maximum understanding is possible.

Research of readability formulas

The fundamental research in readability has been concerned mainly with finding objective methods of estimating the difficulties of printed materials. Three kinds of studies have contributed to this objective: quantitative studies characterized by readability formulas, surveys by experts which include librarians, teachers and publishers, reader opinion including adults and high school students, and experimental studies.

The quantitative studies sought to find a mathematical equation which when applied to sample passages would

give an index of the reading ease or difficulty of the material without testing it on readers. Chall (1956) points out that since 1922 about 29 quantitative studies have appeared.

In these studies, investigators started with books or passages that ranged in reading difficulty. They were ranked or graded in some way, either by tested reader comprehension, judgment of experts, or publisher's assigned grade level. This material was then analyzed for kinds of words, sentences, and like elements that distinguish the easier books from harder books. Content, style, format and organization were found to influence difficulty in reading. This agrees with Gray and Leary's (1935) survey. Those factors that could be reliably measured, and were closely related to ease or difficulty, were combined into a formula that could be used to predict the difficulty of similar material.

Only elements of style, so far, have been measured reliably and have been included in readability formulas. Elements of style include vocabulary load, sentence structure and diversity. The structure of the word is the basis upon which it is classified as easy or hard. Sentence structure is the second most important element of style; usually the longer the sentence, the harder the selection. Diversity, especially important to elementary materials, has to do with the number of different words.

Research began in the 'twenties when educators and psychologists were searching for an objective means of grading books. Earlier studies revealed textbooks were too difficult for the students, and technical terms were inadequately explained with insufficient repetition of words for mastery. The importance of vocabulary was made clear, Gray (1947) revealed, with an analysis of the McGuffey Readers. This led to vocabulary studies by Lively and Pressey (1928), Vogel and Washburne (1928), Johnson (1930), Patty and Painter (1931) and Yoakam (1939) which led to measuring difficulties in reading materials. Then vocabulary lists of commonly used words were formulated by Thorndike, Dale and others. Because of this work Chall (1956) revealed primary grade materials, since the twenties, have decreased in number of difficult words, increased in the number of words found in commonly used lists of words with enough repetition of words to obtain mastery.

The Lorge (1939) readability formula was one of the first easy to apply formulas. By counting the relative number of different uncommon words, the average sentence length, and the relative number of prepositional phrases, a good index of readability in terms of grade scores was available. Lorge introduced his formula to government agencies at a seminar in 1939 and suggested ways it could be applied. By

the mid-forties, government agencies were checking the readability of their publications and setting standards. By 1945, a readability labratory was organized to check publications of government agencies.

Newspapers, too became involved with readability after Flesch's (1943) formula was produced which used three factors; average sentence length, relative number of affixed morphemes and relative number of personal references. By 1948, the Associated Press had conducted a readability campaign with Flesch as consultant. Flesch felt his formula was superior over previous ones for use with adult materials. He proved the Lorge formula failed to discriminate satisfactorily between materials above eighth grade difficulty.

Dale-Chall (1948) used Flesch's formula to evaluate educational materials published by the National Tuberculosis Association. They found some shortcomings. The counting of affixed and personal references could be arbitrary. Because of these problems they sought a more efficient means of predicting readability. They used the same sample of the McCall-Grabbs, "Standard Test Lessons in Reading." (1925) used by Lorge and Flesch, the Dale List of approximently 3,000 words, and a factor of sentence structure. They also conducted several experiments comparing the two-factor formula predictions with judgments of experts and actual comprehension

scores of readers on passages. The correlations were .92 and .90.

After Dale-Chall's experience with his formula Flesch revised it. Klare (1975) pointed out that Flesch's (1948) Reading Ease formula became one of the most widely used in the history of measurement.

George Spache (1953) developed his formula for primary grade materials. He validated his formula against the levels of 152 books in common use in the first three grades. He found a multiple correlations coefficient of .818. Stone (1956) added to the accuracy of Spache's formula by replacing 173 words in the Dale List of 769 with words from Krantz's "The Authors Word list," and his own, "A Graded Vocabulary List for Primary Reading."

A 1950 revision of the McCall-Crabbs, "Standard Test Lessons in Reading," which reflected some of the changes in pupil reading abilities due to World War II, atomic energy and modern aviation, provided the opportunity for Powers, Sumner, & Kearl (1958) to recalculate several widely used formulas. They found Flesch's Reading Ease formula which had a correlation of .70 with the 1925 McCall-Crabbs' scores, correlated .64 with the 1950 McCall-Crabbs' scores. Dale-Chall's (1946) correlations of .70 and .71 were almost the same with both sets of scores. Klare (1963) said this con-

sistent evidence of high correlation accounts for the fact that the Dale-Chall formula was the most accurate general-purpose formula available up to 1960. Powers, Sumner, and Kearl (1958) also recalculated the Farr-Jenkins-Paterson (1951) formula and found a correlation of .58, and a correlation of .59 with Robert Gunning's Fog Index (1952).

History of related research from the 'sixties

From the 'sixties on there were more revisions of existing formulas, the introduction of new formulas, another vocabulary list, and Taylor's (1953) cloze procedure which could have significant implications for use in the computer age.

The Dale list of 3000 words consisted of those general words known to 30 per-cent of fourth grade students. Brown (1965) developed his revision of the Dale-Chall formula by adding seven commonly known science words to the Dale List which he thought it lacked. He then found science books to have a more realistic level of readability. Stocker (1968) used the same reasoning with Catholic words. He added 204 words familiar to 80 per-cent of fourth grade Catholic students. This gave a more accurate measure to Catholic materials. The Dale-Chall formula was recalculated and revised by Holmquist (1968) using the 1961 edition of McCall-Crabbs' scores, and an expanded Dale List of 3,102 words.

The resulting correlation was .69.

Spache (1974) revised his formula on the basis of the Harris-Jacobson Basic Elementary Reading Vocabularies. He reported a correlation of .95 between formula scores and grade level primary books.

The Lorge (1939) formula was simplified by Baker and Stokes (1968) providing a saving of over one minute in analyzing a 100-word sample. Tretiak (1969) further simplified it when he recalculated the formula using the 1961 edition of the McCall-Crabbs' lessons.

New formulas became known. Smith (1960-61) published his formula, Devereaux, designed to cover grades four through twelve. Jacobson (1961) developed special formulas for high school and college chemistry and physics textbooks. The Roger's (1962) formula predicts comprehension of materials to be presented orally. Danielson & Bryan (1963) developed a formula specifically for automated use. He used the McCall-Crabbs' (1961) lessons as a criterion with a result of a .575 correlation.

Botel's (1962) formula determines grade levels from primer through twelfth grade from a graded vocabulary list. He validated his formula by comparing vocabulary with that used at various levels of basic readers in elementary, junior and senior high school; and in Readers' Digest, Time Magazine

and the New York Times.

Fry's (1968) readability graph is a simple formula taking only two pages. The Graph yields thirteen levels with an accuracy within a grade level. It is validated on elementary and secondary materials and correlates well with Dale-Chall, Flesch, Spache, Botel and SRA formulas. Maginnes (1969) has extended the Fry graph downward through the preprimer level.

The Coleman (1965) formulas are notable for using the cloze procedure as a criterion rather than the McCall-Crabbs lessons. Bormuth (1967) and Rankin (1964) in their research on the cloze procedure showed cloze readability tests are highly valid and highly reliable measures of the comprehension abilities of students and of the comprehension difficulties of materials. Miller (1972-1974) pointed out that formulas consistently yield higher predictive validity coefficients using cloze scores as a criterion than by using the multiple choice scores of McCall-Crabbs' lessons. Klare (1974-1975) also points out that cloze scores used as criterion are an asset to computer analysis because of their objectivity and convenience.

Limitations of readability formulas

Chall (1949) reminds us that readability formulas are limited as yet, for they do not measure all factors involved in comprehending written materials. Chall (1956) also points

out that the measurement of readability lags behind the number of studies by expert judgment and experimental findings because of the restrictions set on formulas by the requirement of quantification.

Ricker (1978) stresses that teachers weigh these numerous factors with sensitivity and good judgment when selecting reading materials for their students.

Assests of readability formulas

Readability formulas have made a major contribution to assertaining the difficulty level of reading materials in education and industry since the early 'twenties. They analyzed such important aspects of style as vocabulary load, sentence length, and the structure of words.

Existing formulas, particularly the Lorge, Flesch, Dale-Chall and Spache have been continually recalculated, revised, and simplified over the years. Materials such as the McCall-Crabbs, "Standard Test Lessons," and the Dale list of words on which the formulas were validated were also revised over the years based on changes and additional knowledge found in students and adults vocabularies.

Additional materials gaining recognition as valid, predictive criterion is the cloze readability tests and the Harris-Jacobson vocabulary lists.

A very important measuring tool is Fry's (1968) Graph.

It is simple to use, determines readability by grades from first through college level, and is accurate to within a grade level. It also enjoys a high correlation with such reliable formulas as Flesch, Spache, and Dale-Chall formulas.

Conclusion

Readability formulas give an approximation of the difficulty of reading material. The important factors of conceptual difference, organization of material, or the logic, semantic variations in words have yet to be incorporated in formulas. Therefore, while formula measurements are very important they must be used with sensitivity and good judgment in choosing appropriate materials. Gray (1949) states that one-third of readability problems are solved with interesting themes and two-thirds of the problems are solved if the style suits the needs of the reader. Readability formulas can help solve the problems of style.

Readability measurements have been an aid in identifying and constructing special materials for retarded readers, Ruth Strang's, Gateway to Readable Books, and George Spache's, Good Books for Poor Readers, used readability formulas to estimate the reading levels of books for retarded readers. For adults with limited and average reading ability Gray & Leary included the readability levels of 350 books of general interest to adults in, What Makes a Book Readable, and, Books

for Adult Beginners, was published by the American Library Association in 1954.

Fry (1975) noted that at least one major library reference volume, The Elementary School Library Collection, is gradually working a readability formula on every book commonly found in the elementary school library. Since Fry's (1968) Graph is a faster and simpler method to determine readability he hopes it will be widely used as an important, objective method of determining readability.

Using Fry's Graph, three editions of six reading texts were analyzed to determine their grade levels. The results of this work will reveal objective information which will be available to teachers to use as a tool in their selection of materials, and/or to researchers who may have use for this data.

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APPENDIX

Sample of the Readability of Three Editions
of a Textbook Using Fry's Graph

Spache, George D. and Evelyn B. Spache. Reading in the Elementary School. Boston: Allyn and Bacon, Inc.

edition	page	passage	syllables	sentences	reading level
1969	12	1st	175	4.7	15th
	309	2nd	165	4.6	13th
	509	3rd	176	5.3	16th
			3)516	3)14.6	
			172	4.9	14th

range 13 - 16
reading level 14th

---

edition	page	passage	syllables	sentences	reading level
1973	7	1st	153	4.3	10th
	295	2nd	159	3.9	12th
	583	3rd	161	3.4	13th
			3)473	3)11.6	
			158	3.9	12th

range 10 - 13
reading level 12th

---

edition	page	passage	syllables	sentences	reading level
1977	6	1st	163	3.6	13th
	193	2nd	177	4.1	16th
	472	3rd	166	3.5	14th
			3)506	3)11.2	
			169	3.7	14th

range 13 - 16
reading level 14th

GRAPH FOR ESTIMATING READABILITY — EXTENDED

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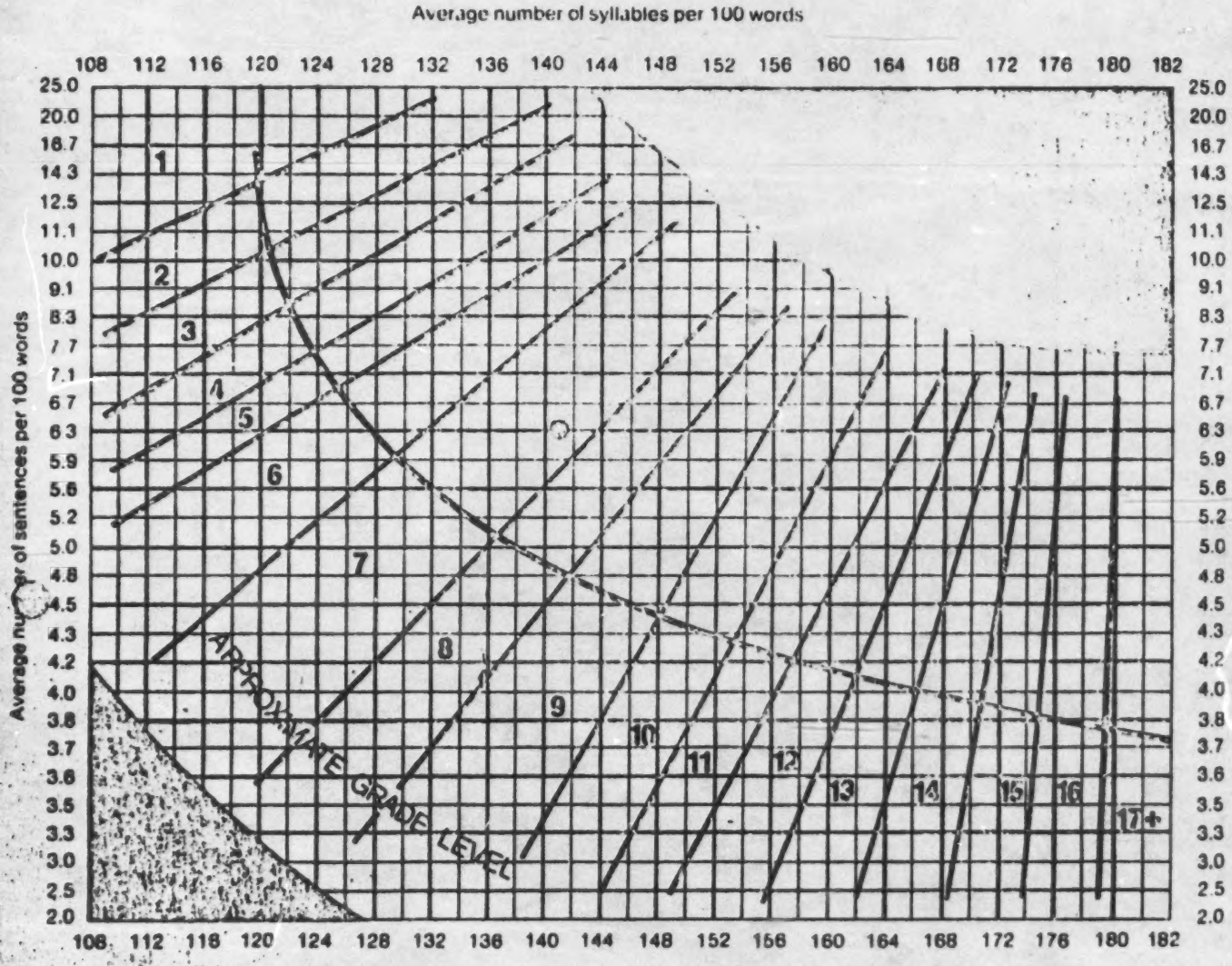

DIRECTIONS: Randomly select 3 one hundred word passages from a book or an article. Plot average number of syllables and average number of sentences per 100 words on graph to determine the grade level of the material. Choose more passages per book if great variability is observed and conclude that the book has uneven readability. Few books will fall in gray area but when they do grade level scores are invalid.

Count proper nouns, numerals and initializations as words. Count a syllable for each symbol. For example, "1945" is 1 word and 4 syllables and "IRA" is 1 word and 3 syllables

EXAMPLE:	SYLLABLES	SENTENCES
1st Hundred Words	124	6 6
2nd Hundred Words	141	5 5
3rd Hundred Words	158	6 8
AVERAGE	141	6 3

READABILITY 7th GRADE (one dot plotted)

BEST AVAILABLE COPY

EXPANDED DIRECTIONS FOR WORKING READABILITY GRAPH

1. Randomly select three (3) sample passages and count out exactly 100 words beginning with the beginning of a sentence. Do count proper nouns, initializations, and numerals.

2. Count the number of sentences in the hundred words estimating length of the fraction of the last sentence to the nearest 1/10th.

3. Count the total number of syllables in the 100-word passage. If you don't have a hand counter available, an easy way is to simply put a mark above every syllable over one in each word, then when you get to the end of the passage, count the number of marks and add 100. Small calculators can also be used as counters by pushing numeral "1", then push the "+" sign for each word or syllable when counting.

4. Enter graph with <u>average</u> sentence length and <u>average</u> number of syllables; plot dot where the two lines intersect. Area where dot is plotted will give you the approximate grade level.

5. If a great deal of variability is found in syllable count or sentence count, putting more samples into the average is desirable.

6. A word is defined as a group of symbols with a space on either side; thus, "Joe," "IRA," "1945" and "&" are each one word.

7. A syllable is defined as a phonetic syllable. Generally, there are as many syllables as vowel sounds. For example, "stopped" is one syllable and "wanted" is two syllables. When counting syllables for numberals and initializations, count one syllable for each symbol. For example, "1945" is 4 syllables and "IRA" is 3 syllables, and "&" is 1 syllable.